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# Magnitude of chronic energy deficiency and its associated factors among women of reproductive age in the Kunama population, Tigray, Ethiopia, in 2014

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## Abstract

**Background:** Women in the reproductive age group are most vulnerable to malnutrition. Maternal and child undernutrition is the underlying cause of 3.5 million deaths each year and 11 % of the total global disease burden. Among women in sub-Saharan Africa, 10–20 % are classified as excessively thin. The 2011 Ethiopian Demographic and Health Survey (EDHS) has reported that 27 % of Ethiopian women and 40 % of Tigray women of reproductive age are too thin. There is no previous study done on the nutritional status and associated factors of women of reproductive age among Kunama women, the minor group. The aim of the study is to assess the magnitude of chronic energy deficiency and its associated factors among women of reproductive age in the Kunama population in Northwest Tigray, Ethiopia, in 2014.

**Methods:** A community-based cross-sectional study was conducted in the Tahtay Adiyabo woreda, Northwest Tigray, Kunama population on 284 women of reproductive age who were selected using simple random sampling technique. Data was collected using structured face-to-face interview and anthropometric assessment from January 27 to March 7, 2014. Data were entered and analyzed using SPSS version 20. Logistic regression was done to identify factors that are associated with undernutrition.

**Results:** The prevalence of undernutrition/chronic energy deficiency (body mass index  $<18.5$  kg/m<sup>2</sup>) was 47.9 % (95 % CI 42.11–53.7 %). Severe (BMI  $<16$  kg/m<sup>2</sup>), moderate (BMI  $<17$  to  $\geq 16$  kg/m<sup>2</sup>), and mild undernutrition (BMI  $<18.5$  to  $\geq 17$  kg/m<sup>2</sup>) was detected in 6.3, 10.6, and 31.0 % respondents, respectively. Age at first marriage (AOR = 2.76, 95 % CI 1.45, 5.25), household food insecurity (AOR = 2.15, 95 % CI 1.05, 4.41), inadequate dietary intake (AOR = 2.93, 95 % CI 1.53, 5.59), time to fetch water (AOR = 2.31, 95 % CI 1.22, 4.41), and meal frequency (AOR = 2.0, 95 % CI 1.003, 3.99) were found to be independent predictors of undernutrition.

**Conclusions:** The prevalence of undernutrition was relatively high among women of reproductive age in the Kunama community. Providing comprehensive and routine nutritional assessment, counseling women at all levels, and increasing involvement of organizations are recommended to address and prevent malnutrition.

## Background

Malnutrition is one of the most devastating problems worldwide and is inextricably linked with poverty [1]. Malnutrition includes both undernutrition and overnutrition. Overnutrition refers to excessive intake of energy and/or macronutrients. Undernutrition can be divided

into protein-energy malnutrition and micronutrient deficiencies [2]. Malnutrition among women is likely to have a major impact on their own health as well as their children's health. Maternal and child undernutrition is the underlying cause of at least 3.5 million deaths each year and 11 % of the total global disease burden [1]. Recent evidence from developing countries indicates that malnourished women with a body mass index (BMI) below

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18.5 show a progressive increase in mortality rates as well as an increased risk of illness [2].

The 2011 Ethiopian Demographic and Health Survey (EDHS) also took weight and height measurements of women age 15–49. Twenty-seven percent of Ethiopian women are too thin. Women living in rural areas are more likely to be thinner than women living in urban areas (29 versus 20 %) [3]. In Tigray, the prevalence of underweight and overweight among women (15–49 age group) is 40 and 3.2 %, respectively, and undernutrition becomes one of the main major public health problems in Tigray [3].

Women in the reproductive age group and children are most vulnerable to malnutrition due to low dietary intakes, inequitable distribution of food within the household, improper food storage and preparation, dietary taboos, infectious diseases, and care. It is well known that chronic energy deficiency is a risk factor for adult low productivity, morbidity, and mortality, with chronic undernutrition among women additionally being a major risk factor for adverse birth outcomes for their children [4, 5].

The nutritional status of women before and during pregnancy is important for a healthy pregnancy outcome. The health extension program in Ethiopia has shown very encouraging results, and the government has now put in all sedentary rural areas a health extension program to reach every family in every Kebele for various preventive and health promotion services, including maternal and child nutrition and health facilities; nutrition service is designed and included in the national nutritional strategy to improve the health and nutritional status of women [6].

Ethiopia is struggling to achieve the Millennium Development Goals (MDGs), particularly goal five to decrease the maternal mortality rate as well as child mortality rate.

However, data on women's nutritional status and its associated factors is rather limited in particular areas such as the Kunama population which belongs to the minority group. Therefore, in this study, the magnitude of undernutrition and the associated factors among women of reproductive age belonging to the minority common was assessed.

## Methods

### Study design, area, and population

This community-based cross-sectional study was conducted on 284 women from Jan 27 to March 7, 2014 in Tahtay Adiyabo woreda Northwest Tigray specifically in two parts of Tahtay Adiyabo (Lemlem and Shimbelina). Pregnant and lactating mothers were excluded from the study for there would be temporary weight gain during these periods. *The three largest ethnic groups reported in Tahtay Adiyabo are the Tigrayan, the Kunama, and foreign residents from Eritrea.* There are 15 health posts

and six health centers in the Tahtay Adiyabo woreda. There is one health post in Kunama catchment and one health center.

### Sample size calculation

The sample size of the study was calculated using the formula for estimation of single population proportion by the assumption of:  $P$  = proportion of women (15–49 age group) that are underweight were 40 % in Tigray [3]. With an assumption of margin of error 0.05 at 95 % confidence level and 10 % non-response rate, using sample size reduction formula, the sample size was 284. Finally, using simple random sampling technique, 284 households were selected. From each household, only one eligible woman at the reproductive age group was selected using simple manual lottery method, interviewed, and measured for her weight and height.

### Measurements

The nutritional status of the women had been determined by taking weight in kg and height in cm; weight had been measured using standardized digital Seka weight scale calibrated to 0.1 kg, and height had been measured using Seka measuring rod calibrated to 0.5 cm [7]. All measurements had been taken twice and the average had been computed. When the two measurements differ by one unit, the measurement had been repeated.

Food diversity of women was determined using women dietary diversity score (WDDS). DDS had been assessed based on the number of food groups consumed over the immediate past 24 h [8]. Based on a set list of nine food items (starchy staples, dark-green leafy vegetables, oils and fats, other fruits and vegetables, organ meat, meats and fish, eggs, legumes, nuts and seeds, milk and milk products), a score lower than 4 was classified as low dietary diversity.

Food security had been assessed using a complete form of household food insecurity access scale (HFIAS), an 18-item scale developed by USAID, and the HFIAS indicators categorized the set of responses into two levels of household food security status: food secure and food insecure. Based on the responses given to the nine questions and frequency of occurrence over the past 30 days, households are assigned a score that ranges from 0 to 27 [9].

### Data collection and quality assurance

Seven 10th grade-completed students who can fluently speak, read, write, and listen kunamigna and two diploma nurses as supervisor were recruited and trained for 2 days by the principal investigator on the study instrument, weight and height measurement, consent form, how to interview, and data collection procedure. The study subjects had been informed about the aim of the study and

confidentiality issue, and informed consent had been secured from the study subject. The data were collected using face-to-face interview and anthropometric assessment. Tools used for the anthropometric assessment were calibrated daily before the assessment begins. After checking all questionnaires for consistency and completeness, the supervisor had presented the filled questionnaire to the principal investigator everyday. Additionally, in order to maintain the quality of the data, the principal investigator rechecked the completed questionnaires, and any problem faced at the time of data collection had been discussed and immediate solution had been given.

### Data analysis

We analyzed data from 284 women. Descriptive analysis as proportions, percentages, frequency distribution, and measures of central tendency had been used. Both bivariate and multiple logistic regression analyses were used to examine associations of various factors with nutritional status of women of reproductive age. To control the effect of confounding factors, variables that had been found significant in bivariate analysis had entered into multivariate logistic regression in order to identify predictors of undernutrition among women of reproductive age with adjusted OR correspondence to 95 % CI. Linearity, outliers, interaction, and multicollinearity had been checked for dichotomous data, and the  $p$  value  $<0.05$  cutoff point was considered as significant for all the independent variables in the model logistic regression employed. Statistical significance was set at 95 % CI and  $p$  value  $<0.05$ . Analysis was conducted using SPSS Inc. version 20.

### Ethical considerations

This study was approved by the Institutional Review Board of the Mekelle University College of Health Sciences. Then, an official letter was gained from the health bureau. Letter of permission was secured from administrative bodies of the area to communicate with relevant bodies in the community. Participation was voluntary, confidentiality ensured, and informed consent secured before the start of each interview.

## Results

### Socio-demographic characteristics of respondents

About 284 women of reproductive age were included with a response rate of 100 %. The mean age of the study participants was  $28.5 \pm 8.97$  (SD) years of age. All participants were Orthodox Christians. More than half of the respondents 154 (54.2 %) were married. Majority of the participants (218, 76.8 %) never attended formal school. The mean family size of the households was five. The mean monthly family income was 654 birr (US\$32.7). Only 154 (54.2 %) reported they had land (Table 1).

**Table 1** Socio demography characteristics of women of reproductive age in Kunama population, Northwest Tigray, February 2014 ( $n = 284$ )

Socio demographic characteristic	Frequency	Percentage
Age of years		
15–19	54	19.0
20–29	113	39.8
30–39	77	27.1
40–49	40	14.1
Marital status		
Married (living with a partner)	154	54.2
Living with no partner <sup>a</sup>	130	45.8
Women educational status		
No education	218	76.8
Elementary	49	17.2
High school	17	6
Women occupation		
Student	35	12.3
Farmer	191	67.3
Merchant	48	16.9
Others	10	3.5
Husband educational status ( $n = 154$ )		
No education	105	68.2
Elementary	32	20.8
High school	17	11
Family monthly income (Ethiopian birr)		
<500	81	28.5
500–1000	186	65.5
>1000	17	6
Family size		
Less than 5	133	46.8
Greater than or equals to 5	151	53.2
Head of family		
Father	169	59.5
Mother	115	40.5
Land ownership		
Yes	154	54.2
No	130	45.8
Land in hectare ( $n = 154$ )		
Greater than or equal to 0.5	80	51.9
Less than 0.5	74	48.1

Family size: the total number of individuals living in the same house

<sup>a</sup>Living with no partner, including single ( $n = 48$ ), widowed, and divorced

### Reproductive and obstetric history of respondents

Out of 236 respondents, 136 (57.6 %) got married at the age of less than 18, and the mean age of respondents at first marriage was  $17 \pm 1.78$  (SD) years of age. The mean

gravidness of respondents was  $3.49 \pm 1.88$  (SD) and the mean parity was  $3.24 \pm 1.69$  (SD). Among 223 respondents, 120 (53.8 %) had given birth within the interval of 24–47 months (mean  $31.17 \pm 1.69$  (SD)), and all of the respondents ( $n = 223$ ) had breastfed their babies with a median of 24 months  $\pm 7.21$ (SD) (Table 2).

#### Respondent characteristics on diet and nutrition-related information

All respondents stated that their commonest staple food was sorghum. No food taboos were reported by respondents. The food source of 231 (81.3 %) respondents was from their own product and market. More than half 148 (52.1 %) of the study participants had an experience of eating three meals per day regularly. Likewise, majority of the respondents (215, 75.7 %; 211, 74.3 %); 186, 65.5 %) used to consume fruit, vegetable, and meat per week, respectively. Of all respondents, 169 (59.5 %) had an exposure to nutritional information from different sources; majority (127, 75.2 %) acquired the information from health professionals (Table 3).

#### Nutritional status of women of reproductive age

Among 284 respondents, more than half (179, 63 % and 162, 57.4 %) were from food-secured households and had an inadequate dietary intake during the past 24 h, respectively (Fig. 1). The mean household food security score was  $11.47 \pm 5.24$  (SD) and the mean 24-h dietary recall score  $4.3 \pm 1.05$  (SD).

#### Respondent characteristics of sanitation, health status, and other environmental factors

Among the respondents, 145 (51.1 %) used open defecation. About 223 (78.5 %) used water from a safe source (protected well and tap water) with a mean fetch time to collect water (per min) of  $24.5 \pm 14.1$  (SD). Most of the respondents (237, 83.5 %) never treat water. About 216 (76.1 %) had no illness within the last 2 weeks before the data collection (Table 4).

#### Nutritional status (BMI) of women of reproductive age

Of all respondents, 136 (47.9 %) (95 % CI 42.11–53.7 %) had a BMI less than  $18.5 \text{ kg/m}^2$  while 148 (52.1 %) of the study participants had BMI  $\geq 18.5 \text{ kg/m}^2$  (Fig. 2). The mean BMI of the respondents is  $19.1 \pm 2.39$  (SD). The mean height (m) and weight (kg) of respondents was  $1.56 \pm 6.26$  (SD) and  $46.7 \pm 6.33$  (SD), respectively.

#### Factors associated with chronic energy deficiency among Kunama women

The multivariate logistic regression analysis was done in looking for association of variables with nutritional status

**Table 2** Reproductive and obstetric history of women in the reproductive age group in Kunama population, Northwest, Tigray, February 2014

Reproductive and obstetric history	Frequency	Percentage
Age of years at first marriage ( $n = 236$ )		
<18	136	57.6
$\geq 18$	100	42.4
History of contraceptive use ever		
Yes	158	55.6
No	126	44.4
History of pregnancy		
Yes	223	78.5
No	61	21.5
Gravidity ( $n = 223$ )		
1–2	83	37.2
3–4	68	30.5
$\geq 5$	72	32.3
History of ANC follow-up ( $n = 223$ )		
Yes	125	56.1
No	98	43.9
Nutritional information during ANC follow-up ( $n = 223$ )		
Yes	99	44.4
No	124	55.6
Iron supplementation during ANC follow-up ( $n = 223$ )		
Yes	106	47.5
No	117	52.5
Parity ( $n = 223$ )		
1–2	89	39.9
3–4	77	34.5
$\geq 5$	57	25.6
Birth spacing between the last of 2 children ( $n = 223$ )		
Not applicable (NA)	40	17.9
<24 months	32	14.3
24–47 months	120	53.8
$\geq 48$ months	31	13.9
Breast feeding in months ( $n = 223$ )		
$\leq 24$ months	178	79.8
>24 months	45	20.2

ANC antenatal care, NA this refers to women who only had one birth during the study period

(BMI). Nutritional status was significantly associated with household food security, age at first marriage, time to fetch drinking water, women dietary diversity, and meal frequency (Table 5).

**Table 3** Respondent characteristic on diet and nutrition-related information of women in the reproductive age group in Kunama population, Northwest Tigray, February 2014 ( $n = 284$ )

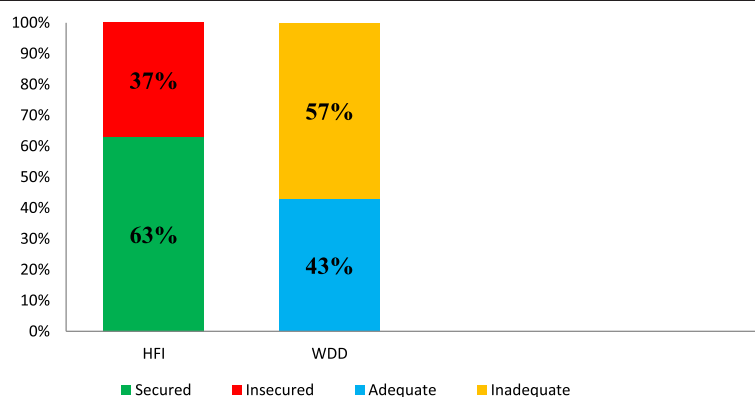
Diet and nutrition-related information	Frequency	Percentage
Source of food		
Own product and market purchase	231	81.3
Market purchase	50	17.6
Own product	3	1.1
Meal frequency per day		
3 times	148	52.1
2 times	136	47.9
Access to any nutritional information		
Yes	169	59.5
No	115	40.5
Source of information ( $n = 169$ )		
Health professional	127	75.2
Media	10	5.9
School	22	13
Peers	10	5.9
Frequency of fruit intake		
Never	32	11.3
Weekly	215	75.7
Monthly	37	13
Frequency of vegetable intake		
Daily	51	18
Weekly	211	74.3
Never and monthly	22	7.7
Frequency of animal source intake		
Weekly	186	65.5
Never and monthly	98	34.5

## Discussion

According to this study, the prevalence of overall undernutrition was 47.9 % (95 % CI 42.11–53.7 %). This was found higher (47.9 %) than findings from the sub-Saharan Demographic and Health Survey (DHS), which ranges from 7 to 37 % [10]. Looking particularly to Ethiopians, the national average was 27 % as well as the regional (Tigray) average of 40 % [3]. The dissimilarity could be due to countries' DHS reports which used to include participants from both the rural and urban. Studies including EDHS 2011 and meta analysis conducted in many countries included 26 sub-Saharan countries; results showed that the prevalence of undernutrition was higher among rural women than urban [3, 11].

The reason for the higher prevalence seen in this study could be that the national as well as the regional EDHS reports included all women of reproductive age from rural and urban areas [3]. This could underestimate the prevalence of undernutrition. The prevalence of undernutrition in this study is also higher than the prevalence seen among Arsi's women (47.9 versus 26.7 %). This could be due to the regional variation of undernutrition. According to a study done based on the EDHS report, women living in Tigray were two times more likely to be malnourished than women in the Oromiya Region [12]. Tigray is mountainous and thus makes farming difficult, which puts women in Tigray at a higher risk of malnutrition than in other regions of Ethiopia.

Earlier studies also showed that the prevalence of undernutrition in Kerala (India), Bangladesh (Asia), Purworejo, and in slum Dhaka was 19, 34, 17, and 30.8 %, respectively [13–16], which is lower than the prevalence of undernutrition in this study (47.9 %). This could be due to the higher food insecurity (37 %) leading to lack of access to adequate, safe, and nutritious food resulting to undernutrition. There was also a large number of subjects (57 %) taking inadequate



**Fig. 1** Nutritional status of women in reproductive age group in Kunama population, Northwest Tigray, Ethiopia, February 2014. NB: HFI household food insecurity, WDD women dietary diversity



**Table 4** Respondent characteristics of sanitation, health status, and other environmental factors among women of reproductive age in Kunama population, Northwest Tigray, Ethiopia, February 2014

Variables	Frequency	Percentage
Latrine availability		
Yes	139	48.9
No	145	51.1
Type of latrine (n = 139)		
Unimproved pit latrine	139	100
Source of water		
Protected	223	78.5
Unprotected	61	21.5
Time to fetch drinking water		
<30 min	171	60.2
≥ 30 min	113	39.8
Water treatment practice		
Yes	47	16.5
No	237	83.5
Water treatment mechanism (n = 47)		
Sieve through cloth	30	63.8
Filter	4	8.5
Wuha agar	13	27.7
Hand washing		
Only before eating	81	28.5
Before eating and after toilet	203	71.5
Washing agents		
Soap	138	48.6
None	146	51.4
Attack of illness for the last 2 weeks		
Yes	68	23.9
No	216	76.1
Type of disease (n = 68)		
Malaria	38	55.9
Intestinal parasite	12	17.6
Kal azar	7	10.3
Unspecified disease	11	16.2
Health service access (n = 68)		
Yes	65	95.6
No	3	4.4
Place of health service (n = 65)		
Governmental	52	80
Private	13	20

NB: protected source of water—protected well and tap water. Unprotected source of water—unprotected well and river

dietary diversified food which reflects low micronutrient intake, affecting and compromising their immunity and indirectly resulting in undernutrition.

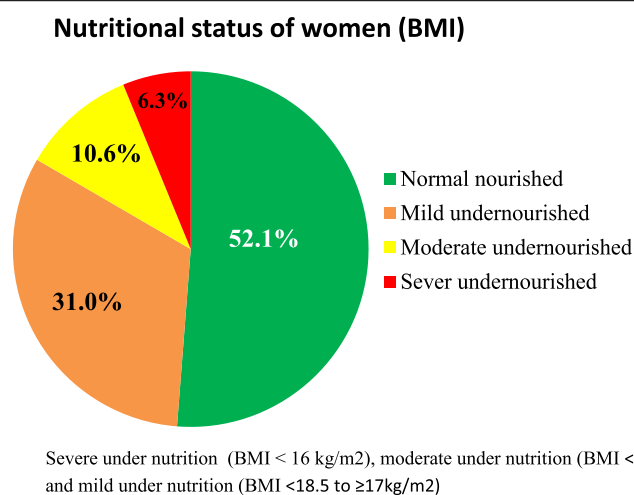
Women who were taking inadequate diversified food were 2.93 times more likely to be undernourished as compared to those who were taking adequate diversified food. The same result was found in studies done in rural Kenya and Burkina Faso among women of reproductive age [17]. Nevertheless, the result of this study is inconsistent with the result done in six states of Nigeria regarding the dietary diversity score. In this study, lower diet diversity score (4.3 vs 5.81) and higher magnitude of undernutrition (47.9 vs 11.3 %) was seen. This could be the reason for the inconsistency of the mentioned results regarding respondents' dietary diversity score [18].

Household food security was positively associated with nutritional status. Women from food-insecure households were 2 times more likely to be undernourished than those women who were from food-secure households. But results from studies done in rural Malaysia and Bangladesh showed no association between food security and nutritional status. This contradiction seen could be due to the difference in assessment tool used. Unlike studies from Malaysia and Bangladesh which used a single question, we used standard multiple questions to assess food insecurity [19, 20]. Household food security is one of the indicators of nutritional status of women. Household food insecurity arises when families do not have enough to eat due to food being neither available nor accessible.

In this study, women having twice per day meal frequency were two times more likely to be undernourished. The result was consistent with an earlier study conducted in the Arsi zone, Oromiya. However, meal frequency had not shown any association with undernutrition in a study done among Bangladesh women of reproductive age. The contradiction could be due to the fact that 78.2 % of the study participants from rural Bangladesh could not afford two meals per day. So, it is tricky to see the effect of meal frequency on respondents which had adequate meal frequency and inadequate meal frequency per day while all of them could not afford two meals or more per day [19].

Those women who were married at the age of 18 and less were more likely to be undernourished than those who were married at the age of 18 and above. The result was the same with that of a study done in Nigeria [21]. Women married at an early age were exposed to frequent child bearing, unplanned motherhood, and abortion, which affected their nutritional status [22].

Those who spent greater than 30 min to fetch water were 2.3 times more likely to be undernourished than those who only spent less than 30 min. Engaging in such activities is mainly a responsibility of women. This might increase the energy consumption of the body, and in the mean time, they would get tired, but still they would have the responsibility to prepare food for the rest of the family members afterwards. This may undermine women's well-being, including nutrition, in substantive ways.



**Fig. 2** Nutritional status (BMI) of women of reproductive age in Kunama population, Northwest Tigray, Ethiopia, February 2014

**Table 5** Logistic regression of nutritional status (BMI) and predictors among women of reproductive age in Kunama population, Northwest Tigray, Ethiopia, February 2014

Predictors	Category	Nutritional status		Odds ratio (95 % CI)	
		Undernutrition	Normal	COR	AOR
Marital status	Married	65	89	1	1
	Living with no partner	71	59	1.648 (1.029–2.638)*	1.234 (0.584–2.604)
Ever used contraceptive	Yes	58	100	1	1
	No	78	48	2.802 (1.727–4.544)*	1.923 (0.975–3.792)
Meal frequency	Twice per day	84	52	2.982 (1.839–4.835)*	2.002 (1.003–3.993)**
	3 times per day	52	96	1	1
Intake of animal source foods	Weekly	73	113	1	1
	Never and monthly	63	35	2.786 (1.678–4.627)*	1.581 (0.791–3.150)
WDD	Adequate	41	81	1	1
	Inadequate	95	67	2.901 (1.776–4.740)*	2.931 (1.536–5.592)**
HFI	Secured	70	109	1	1
	Insecure	66	39	2.635 (1.603–4.331)*	2.158 (1.051–4.417)**
Hand washing agent	Soap	56	82	1	1
	None	80	66	1.775 (1.108–2.842)*	1.313 (0.683–2.524)
Family size	<5	54	79	1	1
	≥5	82	69	1.739 (1.085–2.786)*	1.293 (0.485–3.446)
Age at first marriage	<18	85	51	3.889 (2.242–6.746)*	2.761 (1.450–5.255)**
	≥18	30	70	1	1
Gravidity	Gravid 1–2	32	51	1	1
	Gravid 3–4	33	35	1.503 (0.785–2.876)	1.917 (0.851–4.320)
	Gravid ≥5	40	32	1.992 (1.049–3.784)*	1.31 (0.567–3.026)
Time to fetch drinking water	<30 min	66	105	1	1
	≥30 min	70	43	2.590 (1.588–4.223)*	2.322 (1.220–4.416)**

COR crude odds ration, AOR adjusted odds ration, HFI household food insecurity, WDD women dietary diversity score

Reminder: \*\*significant in both bivariate and multi variant; \* $p < 0.05$  (2-tailed); stepwise (backward LR) was used in logistic regression. 1 = reference

No association was found between educational level and undernutrition in this study (AOR 0.9 % CI 0.49–17). However, the educational level of women of reproductive age had a positive association with the nutritional status of women in studies conducted in India, Bangladesh, and Arsi Oromiya. The prevalence of chronic energy deficiency (CED) was 33.9 %, and the prevalence of CED was almost four times higher among women with no education than those with 12 and more years of schooling in India [23–25]. The reason might be due to the fact that food and related factors that have an effect on nutritional status of women are under the control of the household head. About 74.8 % of women who headed their household were with no education. It was reported that most respondents (80 %) at the age of 15–19 went to school and are currently living with their parents so that they have not any power to decide on nutrition and related issues of the household even though they had better education than their parents.

## Conclusions

Undernutrition is a very dreading condition, and it is evident the condition is higher among rural women of reproductive age. The current study showed high prevalence of undernutrition/chronic energy deficiency (BMI <18.5 kg/m<sup>2</sup>) among women of reproductive age in the study area. The majority of women were with inadequate dietary diversity score. Undernutrition (BMI <18.5 kg/m<sup>2</sup>) in women of reproductive age were found to have associated with factors such as age at first marriage, meal frequency, household food insecurity, dietary intake, and time to fetch drinking water collection. Interventions like nutritional rehabilitation, health education regarding micronutrient intake, and early marriage carryout continuous nutritional assessment and screening needs to be applied.

Drafted policies need to be enhanced by targeting towards the food security, particularly in food-insecure households as to increase their agricultural productivity, strengthen their income, and empower women.

Governmental and nongovernmental organizations need to contribute on building of water taps to offer protected waters and for the source to be in reach.

The staple food of all the study participants was sorghum and the consumption of teff; organ meat that are rich in iron was low. It will be vital to conduct studies on the prevalence of anemia and its associated factors among women of the reproductive age.

## Competing interests

The authors declare that they have no competing interests.

## Authors' contributions

SA participated in the conception and design of the study and coordinated the data collection. SA, AS, and GM analyzed the data; SA drafted the manuscript. SA, AS, and GM were involved in the conception, design of the study, fieldwork, and review of the manuscript. All authors read and approved the final manuscript.

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